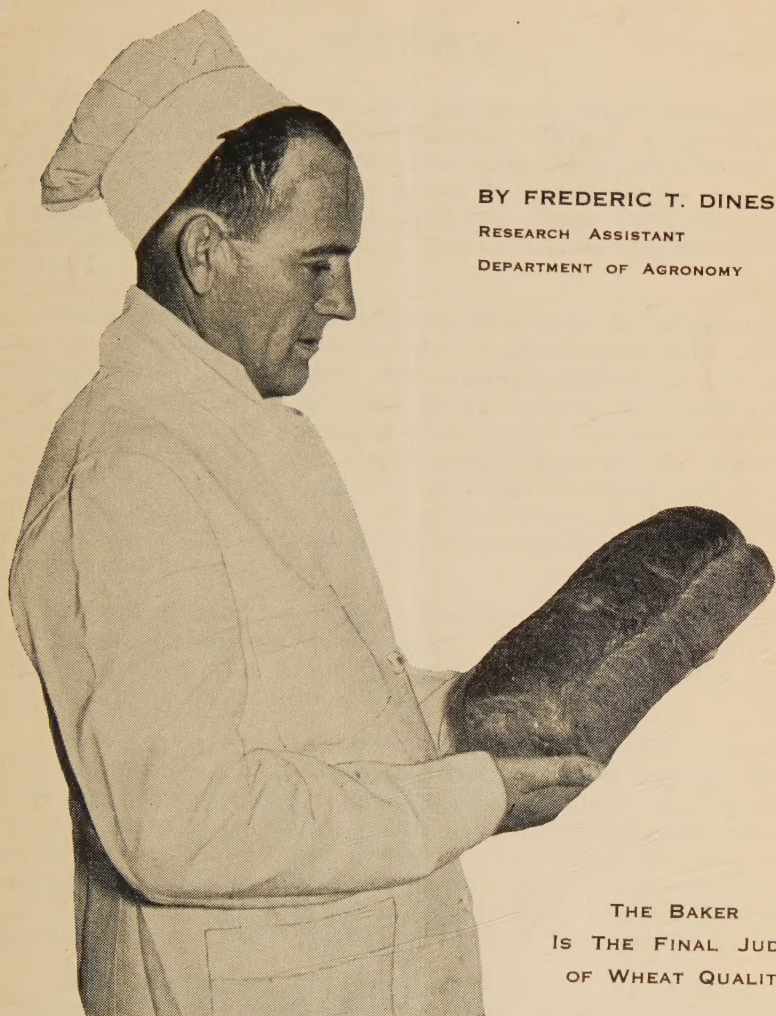


Quality of Wheat Varieties Grown in Oklahoma in 1938



BY FREDERIC T. DINES

RESEARCH ASSISTANT

DEPARTMENT OF AGRONOMY

THE BAKER
IS THE FINAL JUDGE
OF WHEAT QUALITY

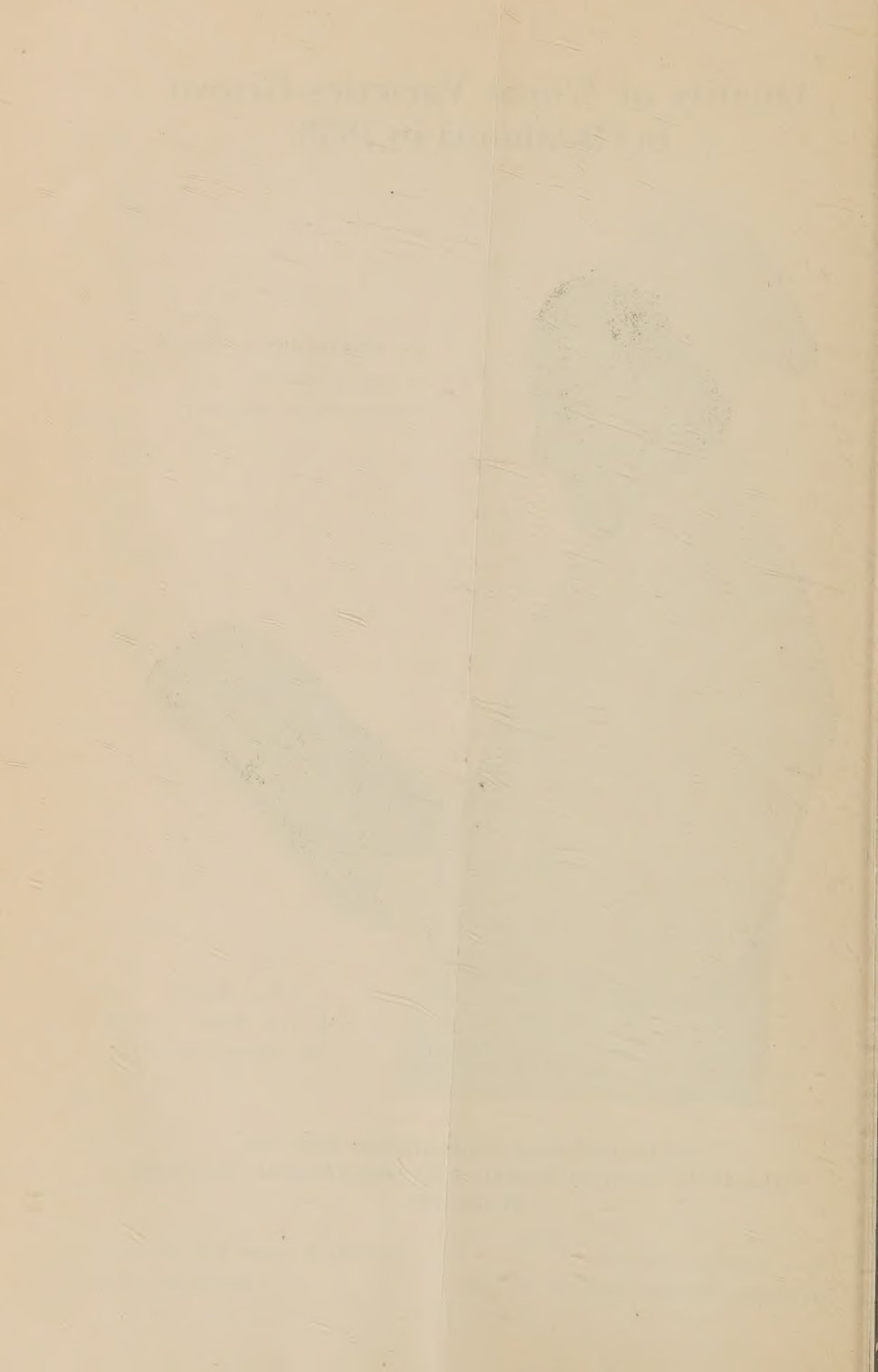
AGRICULTURAL EXPERIMENT STATION
OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE
STILLWATER

W. L. BLIZZARD, DIRECTOR

LIPPERT S. ELLIS, VICE DIRECTOR

EXPERIMENT STATION CIRCULAR No. 85

SEPTEMBER, 1939



SUMMARY

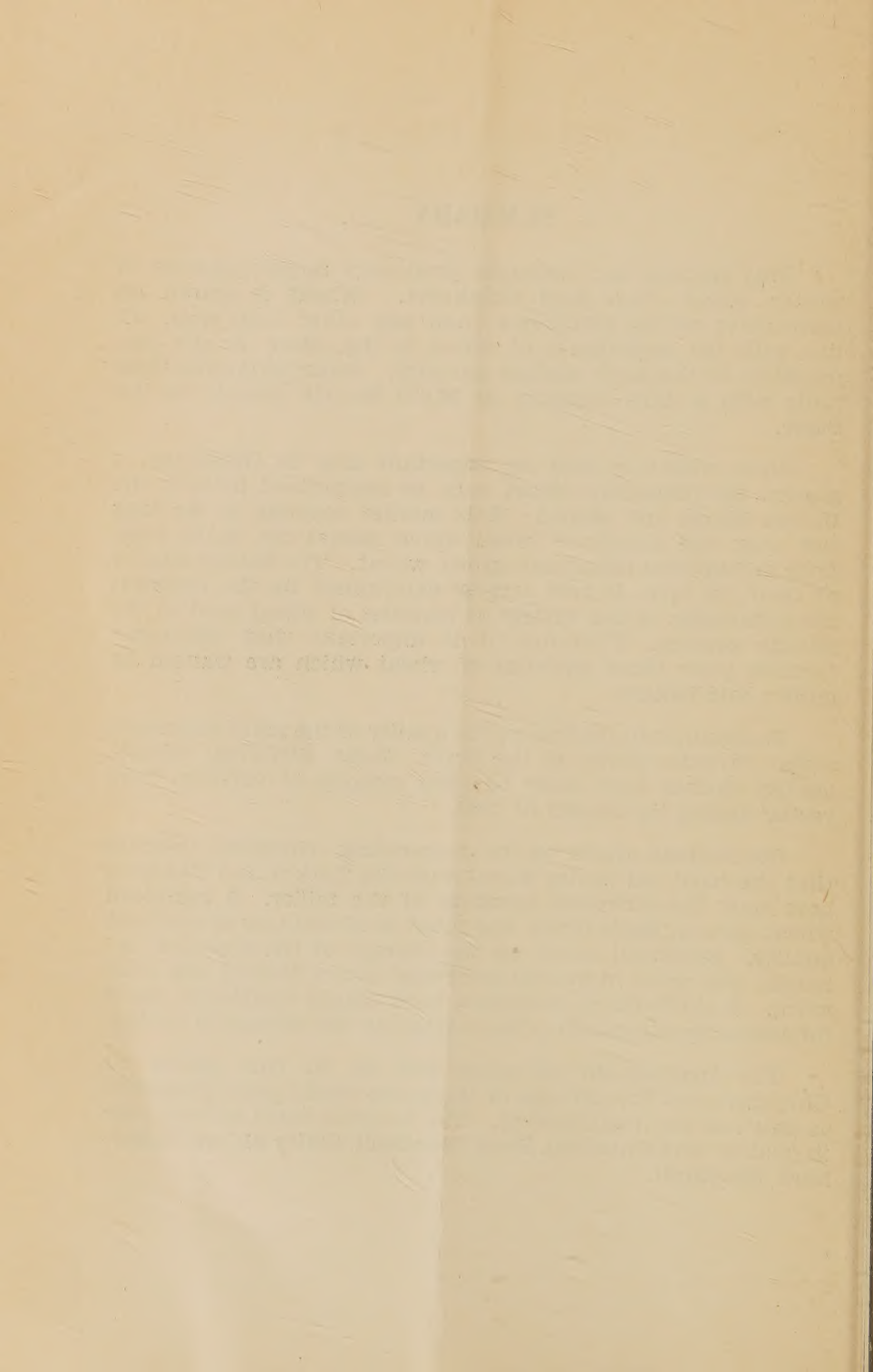
Only Kansas and Nebraska produce a larger quantity of winter wheat than does Oklahoma. Wheat is grown on more acres within Oklahoma than any other field crop. In line with the importance of wheat in the State is the importance of the flour milling industry. Some forty-five flour mills with a daily capacity of 22,870 barrels operate in the State.

Since wheat is such an important crop in Oklahoma, a market for Oklahoma wheat must be maintained both in the United States and abroad. This market depends in the long run upon the quality of bread which bakers can make from flour milled from Oklahoma-grown wheat. The baking quality of flour, in turn, is very largely determined by the inherent characteristics of the variety or varieties of wheat used in the milling process. Therefore it is important that Oklahoma farmers grow those varieties of wheat which are wanted by millers and bakers.

To obtain information on the quality of the more important wheat varieties grown in the State, three different wheat-quality studies were made on pure samples of varieties harvested during the season of 1938.

Conclusions drawn by the cooperating chemists indicate that the hard red winter wheat varieties Turkey and Tenmarq best meet the stringent demands of the miller. A semihard wheat variety, Eagle Chief, was rated as of ordinary good wheat quality. Blackhull, based on the average of the chemists' remarks, was rated in quality somewhat under Turkey and Tenmarq. A short-berry, beardless, hard wheat commonly called Smoothhead was rated on the average as fair to good in quality.

The chemists did not agree well as to the quality of Cheyenne, but the average of the group would place Cheyenne as only fair for breadmaking. The varieties rated as very poor in quality were Chiefkan, Early Blackhull, Sibley 81, and Super-hard Blackhull.



QUALITY OF WHEAT VARIETIES GROWN IN OKLAHOMA IN 1938

By Frederic T. Dines*

Only Kansas and Nebraska exceed Oklahoma in total production of winter wheat. For the 12 years 1927 to 1938 inclusive, Kansas produced an average of approximately 137 million bushels each year, Nebraska 49 million bushels, and Oklahoma 47 million bushels. Texas follows with a 31-million bushel average for the 12-year period.**

The wheat crop in Oklahoma is one of the most important crops in the State from the standpoint of acreage harvested. Average annual acreage of wheat harvested in Oklahoma for the period 1927-1938 was approximately 4 million acres. For cotton it was 3 million acres, for corn 2.5 million acres, and for grain sorghums 1.5 million acres.†

BAKER MUST BE PLEASED

To make flour from Oklahoma-grown wheat, the State in 1937 had some 45 mills with a total daily capacity of 22,870 barrels of flour. Oklahoma wheat is also shipped to mills in other states and in foreign countries.

Most of these mills make flour for the bakery trade. To sell their flour, they must make the kind of flour that bakers want. Since the baking quality of a flour depends to a large extent on the inherent characteristics of the variety of wheat used in making the flour, it is necessary that the miller buy the kind of wheat which will produce the kind of flour demanded by the baker. Therefore, if Oklahoma farmers are to expect a satisfactory price for the wheat they raise, they must grow a variety of wheat which will satisfy the miller so that the miller can in turn satisfy the baker.

*The author and the Oklahoma Agricultural Experiment Station acknowledge gratefully the help of the cereal chemists who made the analyses of wheat quality reported in this circular. Without their generous cooperation, this study would have been impossible.

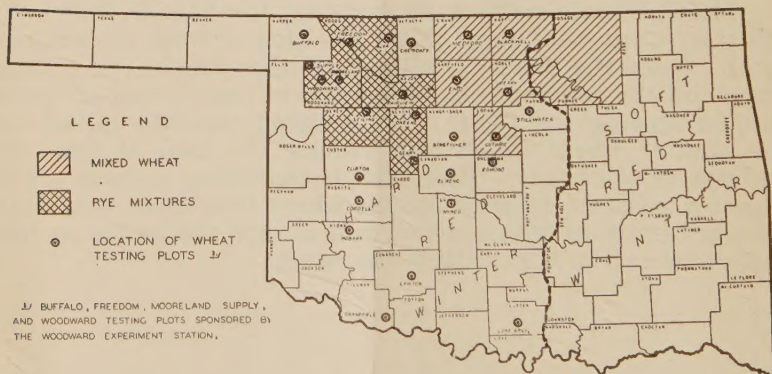
**Cargill Crop Bulletin. Vol. 14, No. 1. Jan. 20, 1939.

†Blood, K. D., and Whittier, John W. December estimates of Oklahoma crops, 1938. Bureau of Agricultural Economics, U. S. Department of Agriculture, Oklahoma City, Okla. December 21, 1938.

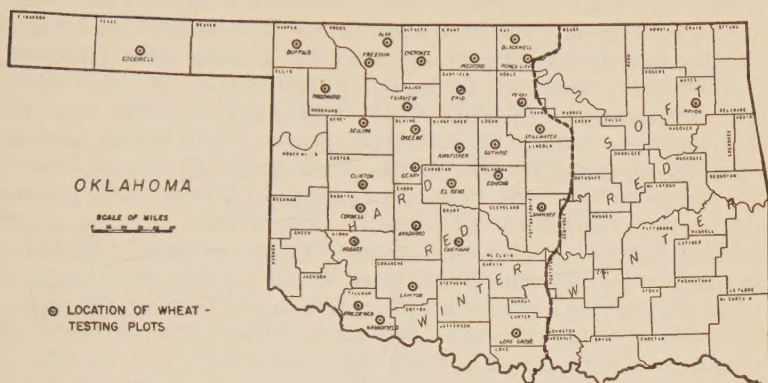
POOR WHEAT IS DANGER

In past years, Oklahoma and other states in the Central and Southern Great Plains Region have earned an enviable reputation among the wheat-importing nations and among millers and grain dealers in the United States. Wheat from this area has been recognized as producing flour with strong bread-making properties. Unfortunately, this reputation has been endangered in recent years by the increasing quantities of off-quality wheat. These poorer grades of wheat include mixtures of different varieties of hard wheat, mixtures of hard and soft wheat, rye mixtures, and "smutty" wheat.

If Oklahoma's reputation for producing high-quality hard red winter wheat is to be maintained, and markets already lost are to be regained, it will be necessary to plant only adapted, high-quality varieties of wheat. This is the goal of the Oklahoma Farm Wheat Improvement Program, which was initiated in 1938 through a cooperative agreement among the Oklahoma Agricultural Experiment Station, the Oklahoma Agricultural



Location of the Oklahoma Wheat Testing Plots for the crop year 1938-1939. The cross-hatched area indicates the five counties of the State which in the years 1935 to 1937 inclusive bore the heaviest losses from production of rye mixtures of wheat. The seven counties covered by slanting lines are those which in the same years bore the heaviest losses from production of mixed wheat.



Location of the Oklahoma Wheat Testing Plots for the Crop Year 1939-40.

Extension Service, the Oklahoma Crop Improvement Association, commercial grain interests, and the bankers and farmers of the State. Part of the work of the Program is the testing and grading of wheat as to seed value. Wheat farmers desiring this service, if they live in counties where the current project is being carried on, may receive it free of charge by submitting a sample to the county agent or sending it directly to the Oklahoma Farm Wheat Improvement Program, Agronomy Department, Oklahoma A. and M. College, Stillwater.

BAKING QUALITY TESTED

The first step toward the goal of a continued market for Oklahoma wheat is to know the baking quality as well as the yielding ability of the different varieties of wheat. This circular reports three tests of baking quality of flour milled from some of the newer varieties of wheat being grown in Oklahoma. The flour from these newer varieties was compared with flour milled from the old standard varieties, such as Turkey and Blackhull. The milling and baking quality of these older varieties is well known to farmers, grain men, and millers; but information is needed on the newer varieties.

In recent years several new varieties of wheat have been introduced into the State of Oklahoma to supplant in no small way the acreage formerly devoted to Turkey and Blackhull. Wheat variety surveys made by agronomists of the United States Department of Agriculture in 1919, 1924, 1929, and 1934 indicate this change in varieties grown.* In 1919 approximately 69 percent of the wheat acreage in the State was of the Turkey variety. In 1924 the acreage of Turkey was reduced to 52 percent, in 1929 to 47 percent, and in 1934, the last survey made, 45 percent of the acreage was Turkey wheat. Blackhull was introduced into the Southwest in 1917, and a small acreage of this variety was grown in 1919, but in 1924 about 12 percent of the State's acreage was devoted to Blackhull. By 1929 the acreage in Blackhull was 34 percent, but the survey in 1934 indicated a drop to 31 percent. Since 1934, it is believed that a further cut in the acreage of Blackhull has been taking place. It is not unreasonable to believe that eventually the old standard wheat varieties may be replaced almost entirely by the newer varieties now being grown in the State or by varieties to be introduced in years to come, if it can be demonstrated that new varieties are superior in yielding ability as well as in milling and baking qualities.

TURKEY IS MILLERS' STANDARD

Although new varieties of wheat are becoming popular with farmers, millers are reluctant to change from the standard of milling and baking quality recognized in the variety Turkey, at least until such time as it is definitely proved that a new variety, or varieties, is at least equal to Turkey in producing a flour which will be in demand among bakers.

In January, 1939, eighty millers in Texas, Oklahoma, Kansas, and Nebraska were asked to rank six varieties of wheat in order of their preference. Sixty-nine millers replied in full. Of these millers, 70 percent ranked Turkey first, and only 4

*Clark, J. A., Martin, J. H., and Ball, C. R.: Classification of American wheat varieties. U. S. Dept. Agri. Bul. 1074 (1922).

Clark, J. A., Martin, J. H. Quisenberry, K. S., et al.: Distribution of the classes and varieties of wheat in the United States. U. S. Dept. Agri. Bul. 1498 (1929).

Clark, J. A. and Quisenberry, K. S.: Distribution of the varieties and classes of wheat in the United States in 1929. U. S. Dept. Agri. Cir. 283 (1933).

Clark, J. A. and Quisenberry, K. S.: Distribution of the varieties and classes of wheat in the United States in 1934. U. S. Dept. Agri. Cir. 424 (1937).

percent ranked it as low as third place. Tenmarq was second, with 25 percent ranking it first preference and 45 percent as second preference. Kanred ranked third, Blackhull and Cheyenne were tied for fourth, and Chiefkan was sixth. The other 11 millers who did not rank all six varieties gave Turkey as one possibility for first, but divided their preference for that variety with such others as Blackhull, Kanred, and Tenmarq.

CHEMISTS STUDY NEW VARIETIES

Since new varieties of wheat are rapidly replacing the old standard varieties, three different studies of the milling and baking qualities of new varieties of wheat were made in comparison with the old standard varieties to determine what new varieties could be recommended as being of equal quality to Turkey. All samples used in these studies were grown in the season of 1937-1938. It must be borne in mind that the results herein reported are for one season's crop only. While they are probably indicative of the relative bread-making qualities of the different varieties, they are not conclusive.

Turkey and Tenmarq Rank High. In Study I, samples were sent to nine milling and baking laboratories in Oklahoma and Kansas. Although there was some divergence of opinion among the cereal chemists as to the quality of the varieties tested, there is no doubt that the Turkey and Tenmarq samples were placed highest in milling and baking quality. The Blackhull sample was not particularly discriminated against. In fact from this study, one would probably rate Blackhull only slightly under the Turkey and Tenmarq samples in baking quality. Without doubt Cheyenne can be rated as only fair from the results obtained. There is no question that Early Blackhull and Chiefkan rank decidedly inferior to the other varieties studied. (The chemists' remarks on the various samples are given in the appendix.)

Chiefkan Made Poor Bread. As the variety Chiefkan had proved so unpopular with the cereal chemists, it was deemed advisable to further study this variety. In Study II, 10 samples of Chiefkan were obtained from various sources in the four states of Texas, Oklahoma, Kansas and Nebraska and were analyzed by laboratory No. 5 in comparison with Turkey and Tenmarq samples.

Three different baking formulas were used in this study. The first formula was that of the chemist's regular procedure.

The second formula had yeast food added. The third formula differed from the regular procedure in having an extended mixing on the doughs.

The general ratings as given the samples in this study are given in Table I.

Table I.—General Quality Ratings Given Samples of Chiefkan, Tenmarq, and Turkey by Laboratory 5.

Sample Number	Variety	Wheat Protein %*	GENERAL RATING		
			Regular Procedure	Yeast Food	Extended Mixing
1	Tenmarq	12.9	Good	Good	Good
2	Turkey	13.7	Good	Good	Good
3	Chiefkan	13.0	Poor	Poor	Poor
4	Chiefkan	13.6	Poor	Poor	Poor
5	Chiefkan	11.8	Poor	Poor	Poor
6	Chiefkan	13.8	Poor	Poor	Poor
7	Chiefkan	13.5	Poor	Poor	Poor
8	Chiefkan	11.0	Poor	Poor	Poor
9	Chiefkan	17.8	Fair	Fair	Fair
10	Chiefkan	11.3	Poor	Poor	Poor
11	Chiefkan	12.5	Poor	Poor	Poor
12	Chiefkan	14.0	Poor	Poor	Poor

*13.50% moisture basis.

The results obtained in this study very decidedly indicate that Chiefkan as grown in the season of 1938 is of an inferior quality undesirable to the bakery trade.

Turkey, Tenmarq, and Eagle Chief Acceptable. Study III was made on eight hard red winter wheat varieties in which a total quantity of 60 bushels for each variety was milled and baked. The varieties included in this study were Blackhull, Cheyenne, Chiefkan, Eagle Chief, Sibley 81, Smoothhead, Tenmarq, and Turkey. (The variety here called Smoothhead is a short-berry, hard wheat grown rather abundantly south and southwest of Enid.) The milling was done in the experimental mill of a large flour-milling company, Laboratory No. 10. The flour was then divided with the testing laboratory of another large milling company, Laboratory No. 11. Thus, two different companies analyzed the baking qualities of the varieties.

The general ratings given the various samples are shown in Table II. They indicate that the varieties Turkey, Tenmarq, and Eagle Chief are acceptable to the milling trade. Two of the Blackhull samples were rated very good by the laboratories. One sample of Blackhull, later determined to be Superhard Blackhull, was strongly discriminated against.

Although the two laboratories were somewhat at variance in their ratings of Cheyenne and Smoothhead, the data given would indicate that the submitted samples of both Cheyenne and Smoothhead would rate only fair on the average.

Both laboratories agreed in giving the general rating of poor to the samples of Chiefkan and Sibley 81.

Table II.—General Quality Ratings of Laboratory 10 and Laboratory 11, Given to 8 Hard Red Winter Wheat Varieties Grown in 1938.

Sample Number	Variety	GENERAL RATING	
		Laboratory 10	Laboratory 11
1	Turkey	Fair	Good
2	Turkey	Good	Good
3	Blackhull	Very Good	Good
4	Blackhull	Very Good	Good
5	Blackhull (Superhard)*	Fair	Poor
6	Tenmarq	Very Good	Good
7	Tenmarq	Good	Good
8	Tenmarq	Fair	Good
9	Eagle Chief	Good	Good
10	Smoothhead	Good	Fair
11	Smoothhead	Good	Fair
12	Cheyenne	Good	Poor
13	Cheyenne	Good	Fair
14	Cheyenne	Fair	Poor
15	Chiefkan	Poor	Poor
16	Chiefkan	Poor	Poor
17	Chiefkan	Poor	Poor
18	Sibley 81	Poor	Poor
19	Sibley 81	Poor	Poor
20	Sibley 81	Poor	Poor

*Sample No. 5 was collected as a Blackhull sample, but later proved to be Superhard Blackhull.

CONCLUSION

The 10 varieties of wheat tested in these three studies may be roughly grouped into three classes according to their suitability for milling and baking. The classes are:

Excellent Quality: Tenmarq and Turkey.

Intermediate to Good Quality: Blackhull, Cheyenne, Eagle Chief and Smoothhead.

Poor Quality: Chiefkan, Early Blackhull, Sibley 81, and Super-hard Blackhull.

It should be remembered that these conclusions are based on wheat samples grown in only one year. However, they agree with the conclusions from similar studies made over a period

of years in other states where hard red winter wheat is grown. Therefore, the results of the one-year test in Oklahoma are probably indicative of the relative bread-making quality of the different varieties studied.

APPENDIX

Chemists' Remarks Concerning the General Quality of Wheat Samples Submitted in Study I.

Study I was made on pure samples of six different varieties, including the old standards: Turkey and Blackhull. These samples were obtained from several locations in the State. The samples were bulked by variety into two distinct composites for each variety excepting Blackhull and Early Blackhull, of which only one composite of each was prepared. These composites were then divided into nine sets containing ten different samples of wheat. The sets and samples within each set were given numbers and sent to nine milling and baking laboratories in Oklahoma and Kansas for quality testing, the variety names being withheld. Eight of these laboratories have reported the results obtained. The general remarks with which the chemists summed up the results of their tests are quoted verbatim in the following pages.*

Turkey, Composite I.

- Lab. 1—A very good variety. O. K. in every respect.
- Lab. 2—The very best of baking quality.
- Lab. 3—Very good baking quality.
- Lab. 4—Ranked No. 1 of the group of 10 samples.
- Lab. 5—This wheat is quite acceptable.
- Lab. 7—A very good type of wheat.
- Lab. 8—Good loaf volume.
- Lab. 9—Very good loaf appearance without bromate treatment, and good loaf appearance with bromate treatment.

Turkey No. II, Single Sample.

- Lab. 1—Satisfactory in every respect from standpoint of variety. Color crumb and flour rather poor account extremely high protein.
- Lab. 2—Rather poor.
- Lab. 3—Excellent.
- Lab. 4—Ranked No. 2 of the group of 10 samples.
- Lab. 5—For making high protein flour with very good mixing tolerance and excellent fermentation tolerance, this wheat is acceptable. With lower protein strength, this variety without doubt would prove acceptable for regular milling and baking requirements.
- Lab. 7—This is a very strong glutenous wheat, resembling the shoe-peg type. This type wheat is eagerly sought by millers for building up the weaker varieties.
- Lab. 8—Poor loaf volume, but should bake a much better loaf with proper treatment.
- Lab. 9—Poor loaf appearance, with and without bromate treatment.

*The chemists' complete reports in numerical terms are being published separately in mimeographed form, and will be available to those interested.

Tenmarq, Composite I.

- Lab. 1—A very good variety. Mixing period and tolerance O. K. A satisfactory bread wheat in every respect.
- Lab. 2—Excellent dough quality. Second best sample of group.
- Lab. 3—Good baking quality.
- Lab. 4—Ranked No. 7 of the group of 10 samples.
- Lab. 5—With the exception of poor fermentation tolerance, this wheat is acceptable where dough stability and strength are not factors.
- Lab. 7—Very good type of wheat. Standard flour against which compared: Unbleached 100% hard straight family flour.
- Lab. 8—Good loaf volume.
- Lab. 9—Good loaf appearance with bromate treatment and fair loaf appearance without bromate treatment.

Tenmarq, Composite II.

- Lab. 1—An excellent variety. Has long mixing period and super-mixing tolerance. Bakes a loaf good in all respects and with very fine crumb. Color and grain good.
- Lab. 2—Good dough quality. Third best sample of group.
- Lab. 3—Normal baking quality.
- Lab. 4—Ranked No. 4 of the group of 10 samples.
- Lab. 5—This wheat acceptable from milling and baking standpoint.
- Lab. 7—Very good type of wheat. Standard flour against which compared: 100% hard straight family flour.
- Lab. 8—Very good loaf volume.
- Lab. 9—Good loaf appearance with bromate treatment, and fair loaf appearance without bromate treatment.

Cheyenne, Composite I.

- Lab. 1—An excellent variety. Excellent mixing tolerance. Good loaf. Satisfactory in all respects.
- Lab. 2—Rather poor in dough quality and baking quality.
- Lab. 3—Fair baking quality.
- Lab. 4—Ranked No. 8 of the group of 10 samples.
- Lab. 5—This wheat acceptable from milling and baking standpoint where dough strength and loaf boldness are not factors.
- Lab. 7—Very good type of wheat. Standard flour against which compared: 100% hard straight family.
- Lab. 8—Very good loaf volume.
- Lab. 9—Inferior loaf, pale crust color, with and without bromate treatment.

Cheyenne, Composite II.

- Lab. 1—An excellent variety. Requires long mixing and has excellent tolerance. Crumb color and grain very good.
- Lab. 2—Fair dough quality, and fair baking quality.
- Lab. 3—Fair baking quality.
- Lab. 4—Ranked No. 6 of the group of 10 samples.
- Lab. 5—This wheat not acceptable from a baking standpoint alone, except for purposes in which stability and tolerance are not factors.
- Lab. 7—This is a good type of milling wheat, yielding a rich cream colored flour. Gluten stability is very good, producing a dough of very good elasticity sufficiently strong for the average baking.
- Lab. 8—Fair loaf volume.
- Lab. 9—Fair loaf appearance with and without bromate treatment.

Blackhull, Composite I.

- Lab. 1—An excellent variety. O. K. in all respects. Flour color dull cream, but bakes out excellent crumb color.
- Lab. 2—Good dough quality. Fair baking quality.
- Lab. 3—Good baking quality.
- Lab. 4—Ranked No. 3 of the group of 10 samples.
- Lab. 5—With the exception of fair yield and somewhat dull crumb color, which possibly could be overcome with proper bleaching treatment, this wheat is very acceptable.
- Lab. 7—A very good type of milling wheat. Standard flour against which compared: Unbleached 100% straight bakers.
- Lab. 8—Good loaf volume.
- Lab. 9—Fair loaf appearance with bromate treatment and poor loaf appearance without bromate treatment.

Early Blackhull (Not a composite but a single sample).

- Lab. 1—Mills soft. A poor variety with very short mixing period and tolerance. This mills a very white flour and shows baking characteristics similar to 1 (Chiefkan, Composite I) and 4 (Chiefkan, Composite II).
- Lab. 2—Fair dough quality. Fair baking quality.
- Lab. 3—Fair baking quality.
- Lab. 4—Chemist did not rank Early Blackhull as there was not enough flour for as complete a study as with the other samples, although the report indicated the resulting bread of one bake had poor color, open grain, and low volume.
- Lab. 5—Not desirable from milling standpoint on account of high ash, but acceptable from baking standpoint if mixing and fermentation tolerance are not factors.
- Lab. 7—Very good type of wheat. Standard flour against which compared: Unbleached 100% hard straight family flour.
- Lab. 8—Good loaf volume.
- Lab. 9—Fair loaf appearance with bromate treatment and young loaf appearance without bromate treatment.

Chiefkan, Composite I.

- Lab. 1—This is an extremely poor variety. Unfit for bread flour. Very short mixing period and no mixing tolerance. Flour very poor color, sharp and granular. Loaf no good.
- Lab. 2—Sticky dough. Fair baking quality.
- Lab. 3—Very short mixing required, and mixing tolerance poor. Fair baking quality, but a wheat undesirable for baking purposes.
- Lab. 4—Ranked No. 9 in group of 10 samples.
- Lab. 5—This wheat not acceptable from baking standpoint. Has not sufficient good baking qualities to be termed suitable for baking purposes in any classification.
- Lab. 7—Very good type of wheat. Standard flour against which compared: Unbleached 100% hard straight family flour.
- Lab. 8—Very poor loaf volume.
- Lab. 9—Fair loaf appearance with bromate treatment and poor loaf appearance without bromate treatment.

Chiefkan, Composite II.

- Lab. 1—An extremely poor variety, unfit for a bread wheat. Very short mixing period and no tolerance. Flour very poor in color, sharp and granular. Loaf no good.
- Lab. 2—Fair dough quality. Fair baking quality.
- Lab. 3—Slightly short mixing required. Fair mixing tolerance. Fair baking quality.
- Lab. 4—Ranked No. 5 in group of 10 samples.
- Lab. 5—Undesirable wheat from milling and baking standpoint because of poor mixing tolerance, poor flour color, coarse granulation, and poor crumb color. Has not sufficient good baking qualities to be termed suitable for baking purposes in any classification.
- Lab. 7—Very good type of wheat. Standard flour against which compared: Unbleached 100% hard straight family flour.
- Lab. 8—Poor loaf volume.
- Lab. 9—Young loaf appearance with and without bromate treatment.

